

THE GENUS *NEOTROMBIDIUM* (ACARINA: LEEUWENHOEKIIDAE)
II. FURTHER NOTES ON SYSTEMATICS, WITH A DESCRIPTION OF
A NEW SPECIES FROM NORTH QUEENSLAND

by R. V. SOUTHCOTT

[Read 13 September 1956]

SUMMARY

The systematics of the genus *Neotrombidium* Leonardi 1901 are reviewed critically. The larval genera *Monunguis* Wharton 1938 and *Cockingsia* Womersley 1954 are synonyms.

A new species of the genus—*N. tridentifer* n. sp.—is described from north Queensland. This is compared with the other species of the genus. Reference is made to the presence of *N. barringtonense* Hirst 1928, the other Australian species, in north Queensland.

The biology of the larvae is referred to briefly; generally it appears that these are ectoparasites on Coleoptera.

INTRODUCTION

In the first paper of this series the writer (1954) described the larva of *Neotrombidium barringtonense* Hirst 1928, obtained from eggs laid by adults in captivity. This correlation enabled the larval genus *Monunguis* Wharton 1938 to be synonymised with the adult *Neotrombidium* Leonardi 1901. Since then a further species of the genus has been reared in North America—*N. tricuspidum* Borland 1956—by Borland (1956), confirming the correlation of these two genera.

In a study of the acarine fauna collected by the writer in 1943 and 1944 in the vicinity of a focus of scrub typhus at Dead Man's Gully, Trinity Bay, north Queensland (see Southcott 1947), a few specimens of the postlarval stages of the genus *Neotrombidium* were found. Some of them belonged to *N. barringtonense*, and were referred to earlier by the writer (1954, *loc. cit.*). There were also, either on their own in the field, or in company with the preceding, a few specimens of an undescribed species of *Neotrombidium*. This, the second Australian species to be described, differs from all other known species in the structure of the dorsal setae. It is described below as *N. tridentifer* n. sp.

The opportunity will also be taken here of reviewing critically the knowledge of the systematics of the genus.

The Systematic Position of Neotrombidium

Womersley (1945, 1954) removed *Neotrombidium* from the subfamily Microtrombidiinae Thor 1935 to his family Leeuwenhoekiidae. However, the systematic position of the genus is by no means generally agreed upon. Thus Borland (1956, *loc. cit.*), in the most recent article on the genus, stated, "There appears to be ample argument for placing *Neotrombidium* in any one of three families. Womersley (1954) placed the genus in the family Leeuwenhoekiidae (Trombiculidae: Leeuwenhoekiinae of authors). Wharton (1947) [1947b—R.V.S.] retained the genus in Trombidiidae but noted some affinities with Trombiculidae. *Neotrombidium* was placed in Trombidiidae by Baker and Wharton (1952), but in the key given by these authors it will fall into Trombiculidae on the character of the paired tectal setae." He continued by saying that he preferred to "leave the genus unassigned until the taxonomy of related genera be-

comes better known, and until family levels are drawn along more definite lines".

Womersley (1945) had founded the family *Leeuwenhoekiiidae* with the following comment: "In 1944 . . . the present writer erected the subfamily *Leeuwenhoekiiinae* for the larval genus *Leeuwenhoekia* Ouds. 1911, on the discovery of a true stigmal opening situated on each side between coxae I and the gnathosoma, from which tracheal tubes ramify* through the body. In this feature the species of *Leeuwenhoekia* s. l. differ from the other genera of the *Trombiculidae*".

André (1943a, b) had independently and earlier described the stigmal openings and tracheae in a species described from Europe as *Leeuwenhoekia paradoxa* André 1943. These reports, however, were not available to Womersley at the time.

Wharton (1947a) erected the subfamily *Apoloniinae* for the genera *Apolonia* Torres and Braga 1938 and *Womersia* Wharton 1947. Although Wharton recorded the presence of stigmata and tracheae in the *Apoloniinae*, he considered that within the *Trombiculidae* the leg segmentation was of greater significance from a systematic point of view, and preferred to use the presence or absence of stigmata and tracheae as a lesser character. Thus in his key to the subfamilies he stated that in the *Leeuwenhoekiiinae* the leg segmentation formula of the larva is 6, 6, 6 (i.e. that legs I, II and III have 6, 6, 6 segments respectively). In the *Apoloniinae*, as in the *Trombiculinae*, the leg segmentation formula is 7, 7, 7. By Wharton's key (1947a; largely repeated in Wharton and Fuller 1952, page 41) the larval *Neotrombidium*, with its segmentation formula of 7, 6, 6, would come down to the *Walchiinae*, but its affinities clearly lie elsewhere. Thus it does not fulfil the other two characters given for the *Walchiinae* (Wharton and Fuller 1952, page 91): that of expanded sensillae in the larva, and the presence of a papilla or a group of papillae on the dorsal surface of tarsus I in the nymph and adult.

Lawrence (1949, page 467), in describing the South African parasitic *Trombiculid* fauna, accepted Wharton's classification, with minor modification. He commented that the genus *Sauracella* Lawrence 1949, with its expanded sensillae and leg segmentation formula 7, 7, 7, could equally well be placed within the *Trombiculinae* or *Leeuwenhoekiiinae*. In discussing the systematics of these two subfamilies he commented that "Even the presence or absence of stigmata and tracheal trunks between the first coxa and the gnathosoma, which should from all considerations be a character of deep-seated significance, no longer retains its former importance, since none of the three new *Leeuwenhoekiiine* genera described [*Hyracarus*, *Austrombicula* and *Austracarus*] in this paper from mammals, have these tracheae. According to Wharton and Fuller (1952, page 96), *Comatacarus* Ewing 1942, placed in the *Leeuwenhoekiiinae*, also lacks these."

On the whole therefore, it would appear that the best decision is to allot the *Leeuwenhoekiiinae* no more than subfamily status, a view to which most students of these mites at present subscribe (for the sake of consistency, however, their family name has been retained in the title of the present paper).

The Synonymy of Neotrombidium

Womersley (1954) gave an account of six larval genera belonging to the *Trombidioidea*, among which were *Neotrombidium* Leonardi 1901 and *Cockingsia* Womersley 1954. The following comment was made on these mites: "This is a heterogeneous assemblage of genera, but on larval characters they would be included in an expanded subfamily *Apoloniinae*, a concept which the writer believes to be useful at the present state of knowledge. A clear line cannot at present be drawn between the *Leeuwenhoekiiidae*, a family largely

* This term was possibly used somewhat loosely by Womersley.

founded on larval characters, and the Trombididae, largely founded on adult characters . . ." and that "placing them in the Apoloniinae *sensu lato* must be regarded as no more than tentative". He retained the family Leeuwenhoekeidae, and in it he placed the Apoloniinae, but no modified definition of the latter was proposed.

Cockingsia tenuipes Womersley 1954 was described in that paper as a new genus and species from Malaya. If, however, it is compared with the description and figures given by the present writer (1954) for the larva of *Neotrombidium baringunense*, from reared specimens, as well as those given by Borland (1956) for larvae similarly reared of *N. tricuspium*, it will be observed that *Cockingsia* is practically identical with larval *Neotrombidium*. Womersley (*loc. cit.*, pages 108, 109) stated erroneously (presumably deriving his data from Wharton, as he refers to personal correspondence with the latter writer) that the legs of the larval *Neotrombidium* are all 7-segmented. Actually, as stated above, in the larval *Neotrombidium* the leg segmentation formula is 7, 6, 6, as both the present writer (1954) and Borland (1956) have described, and as Womersley himself described in *Cockingsia*. The only significant point of difference between the description by Womersley of *Cockingsia* and the descriptions by myself and Borland of larval *Neotrombidium* is Womersley's statement that in *Cockingsia tenuipes* that "Spiracle between gnathosoma and coxae I present, but only beginning of tracheae observed". The present writer has re-examined his own specimens of the reared larvae of *N. baringunense* (bred as described earlier) and has been unable, as he has been previously, to find any stigmata or tracheae between the gnathosoma and coxa I of each side, and is convinced that such are not present. Nor does Borland refer to any, or figure any sign of them in his obviously carefully drawn figure of the larva of *N. tricuspium*.

In an attempt to clarify this problem the writer has examined the type series (16 specimens) of *Cockingsia tenuipes* in the collection of the South Australian Museum. He has been unable to see any stigma or trachea in the position figured by Womersley. Occasionally in that situation the skin has tended to fold, and this could account for Womersley's description and figure. It may be commented that in the genus *Acomatacarus*, which is widespread in Australia and elsewhere, that the spiracle can be recognized without difficulty even in old mounts.

In the writer's opinion, therefore, *Cockingsia* Wom. 1954 is a synonym of *Neotrombidium Leonardi* 1901, and Womersley's species is allotted the name *Neotrombidium tenuipes* comb. nov. In that species, in the lateral parts of coxa I and III, there is a reticular pattern described by the writer (1954) and Borland (1956), reminiscent of the reticular pattern of the coxae of the postlarval stages, in their lateral parts. *N. tenuipes* is, however, quite a distinct species, and may be separated on biometric data quite easily from the other species, as recorded below.

With regard to *Monunguis* Wharton 1938, Borland (*loc. cit.*), following advice from Wharton, suggests that *Monunguis* may eventually have to be revived as a separate genus. Various morphological characters are given as evidence in support of that viewpoint, one such being that the larval *Monunguis streblida* Wharton 1938 has upon its dorsal scutum an "incipient crista", of which only faint traces can be made out in *Neotrombidium tricuspium* Borland 1956. However, Borland himself destroys the force of that argument with the admission that "therefore, with respect to the scutum, *M. streblida* differs from *Neotrombidium [tricuspium]* larvae in degree only". Borland continues by stating that other characters by which these two species differ are the greater number of dorsal setae and the greater plumosity of the dorsal setae in *Monunguis*, and the fact that the body (idiosoma) is pear-shaped while the other larvae assigned to *Neotrombidium* are of ovoid body form. With regard to the last character the

present writer is not prepared to concede at the present time that it is even of specific value, even in unmounted unengorged specimens. The other characters quoted do not appear to the present writer to be of much significance generically, as they are largely differences of degree, and as acarologists customarily use these setal characters for the separation at the species level.

There are three discrepancies between Wharton's (1938) account of *Monunguis* and the characters of larval *Neotrombidium* as described by both the present writer and Borland. The first of these lies in the fact that Wharton claimed in his original account that coxa I and coxa II are separated on each side (and on that account suggested that *Monunguis* and *Rohaultia* Ouds, 1911 occupied an intermediate position between the families Trombidiidae and Erythraoidae). Although the present writer made this point in his article in 1954, Borland (*loc. cit.*), although he quotes that article, has not seen fit to deal with it in his recent examination of a cotype of *M. streblida*. The second discrepancy is also of importance. Wharton (1938) stated that *Monunguis* resembled *Rohaultia* in another character, that of having "divided femora". Presumably this means that the legs are all 7-segmented, as Womersley stated (*see above*). The third discrepancy lies in Wharton's statement that in *Monunguis* there is a single seta to each coxa. In larval *Neotrombidium* there are two setae to coxa I, and one to each coxa II and III (Southcott 1954, Borland 1956). These second and third discrepancies likewise are not dealt with by Borland. It is quite clear that Wharton's *M. streblida* badly needs a critical re-examination, and description. Until such time as that is done, however, the present writer can see no reason against accepting the view proposed earlier by the writer (1954) and Borland (1956) that *Neotrombidium* and *Monunguis* are synonymous.

The following synonymy is therefore proposed:

***Neotrombidium* Leonardi 1901**

Trombidium Berlese, 1888 (part).

Neotrombidium Leonardi 1901, Berlese 1912, Hirst 1928, 1929, Womersley 1934, 1936, 1937, 1945, 1954 (post-larval forms), Thor 1935, 1936, Thor and Willmann (1947), Wharton 1947b, Baker and Wharton 1952, Audy 1954, Southcott 1954, Borland 1956.

Monunguis Wharton 1938 (larval).

Cockingia Womersley 1954, Audy 1954 (larval).

***Neotrombidium tridentifer* n. sp.**

Fig. 1 A-H

Description of Adult (mostly from mounted specimen, Type, ACB 194) (Fig. 1 A-H): Colour vermilion in life. The body of the usual elongate shape for the genus, with its constricted middle ("figure of eight") (the type specimen is probably slightly swollen by the mounting). Body 1350 μ long by 570 μ wide; densely clothed with coarse 3-pronged setae as figured (Fig. 1 F-H), which are mostly directed posteriorly, the setae near the "shoulders" being an exception. Dorsal setae 40-50 μ long by 20-24 μ wide across the prongs. The lateral prongs are coarsely barbed and pointed. The central element of the seta is expanded distally, and is club-like, with projecting or sessile bract-like or bead-like cilia-tions; below the central prong has a double row of fringing, sharp-pointed cilia-tions. The dorsal setae become coarser posteriorad. On the ventral surface of the idiosoma the investing setae are similar to the dorsal, but are slightly smaller and more delicately fashioned.

Eyes cannot be seen in any of the type series. It cannot be decided definitely whether they are present or absent from these specimens, owing to the density of the dorsal setation (in *N. barringtonense* each lateral pair of lenses is but lightly chitinised).

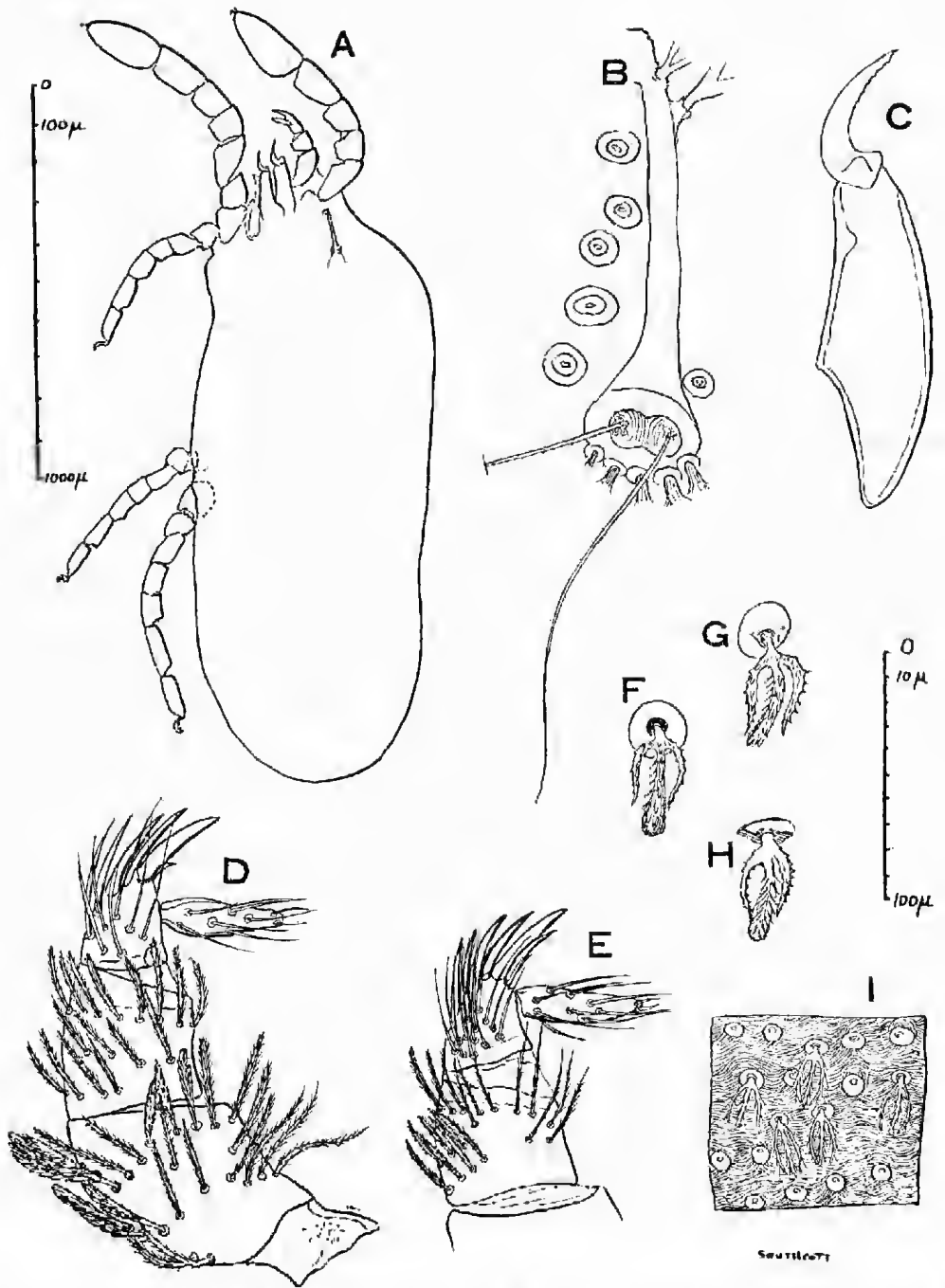


Fig. 1 A-II.—*Neotrombidium tridentifer* n. sp. Adult. A: entire, setae omitted, to scale on left; B: crista; C: right chela; D: left palp, external view; E: left palp, internal view; F, G, H: dorsal setae, F, G, dorsal views, H ventral view; I *Neotrombidium barringtonense* Hirst 1928, adult: piece of skin of the dorsum with setae, to same scale as F, G, H (B-I all to same scale, that on right of figure).

Dorsal crista as figured, about 165μ long, provided with a single sensillary area, large, at its posterior end; an area 43μ across by 34μ long, with two filiform very finely barbed sensillary setae 150μ long. In the type specimen the anterior end of the crista and tectal area are obscured by distortion and the heavy investiture, but in specimen ACB 263A (paratype) the pair of tectal setae are visible, strong, pointed, strongly ciliated, 64μ long.

Legs as figured, I 800μ long, II 515μ , III 525μ , IV 725μ (all lengths including coxae and claws). The legs are clothed with a normal type of Trombidiid setation, there being no trifurcate setae present. Proximally on the legs the setae are lanceolate or lanceolate-clavate, with coarse, pointed ciliations; distally the setae are fine, pointed, with hair-like ciliations. The lateral (distal) half of the coxa of each leg is patterned with punctae in each leg, similar to that of *N. barringtonense*, but with the spaces smaller owing to the coarser reticulation septa. Tarsus I is 200μ long by 90μ high (exclusive of claws); metatarsus I 128μ long by 76μ high; tarsus IV 130μ long by 40μ high (exclusive of claws); metatarsus IV 122μ long by 50μ high.

Palpi as figured. The palpal tibia carries a strong claw with a basal coarse barb or peg, and one accessory tooth ventromedially; dorsally there is also a row of 4 stout accessory spines to the claw, as figured. The palpal tarsus is slender, with fine spiniform setae.

Chelicerae as figured, with a fairly strong falciform, pointed movable chela with a distal dorsal row of 6 minute denticles.

Genitalia of adult are as previously recorded for this genus, with the normal labia majora, each provided with two long suckers and with a row of ciliated tapering setae. The genital aperture is surrounded by rows of inwardly pointing, elongated and ciliated 3-pronged setae.

Localities: Specimens ACB 194A (type) and ACB 194B (paratype) were found among leaf litter at the base of *Eucalyptus* sp., Palm Beach, Cairns, Queensland, on 12th December, 1943. Specimen ACB 263A (paratype) was obtained under bark of *Eucalyptus* sp., along with 4 specimens of *N. barringtonense* Hirst 1928 (ACB 263B-E), at Dead Man's Gully, Cairns, Queensland, at Map Reference (Cairns 1:63,360) 614863, 29th November 1943. (All specimens collected by writer; in writer's collection.)

The Systematic Position of Neotrombidium tridentifer

This species (known only from the adult) can be distinguished quite easily from the only other adult *Neotrombidium* described from Australia, *N. barringtonense* Hirst 1928, on the structure of the dorsal setae. In *N. tridentifer* the dorsal setae are of a coarse structure, to 50μ long, with unequal prongs. In *N. barringtonense* the dorsal setae are smaller, to 30μ long, and consist of three delicate and nearly equal, flexible, finely ciliated prongs. These differences are illustrated in Fig. 1 G-I.

Neotrombidium barringtonense Hirst 1928

Fig. 1 I

Six specimens of this species were collected by the writer in the Trinity Bay area of north Queensland. The dorsal setae on a piece of the integument of one of these (ACB 200) are shown in Fig. 1 I. The following is a list of the specimens and localities: (1) One specimen, ACB 200, under bark of *Eucalyptus* sp., Dead Man's Gully, Map Reference (Cairns 1:63,360) 617863, 31st December 1943; (2) Four specimens, ACB 263B-E, along with specimen ACB 263A, a paratype of *N. tridentifer* n. sp., under bark of *Eucalyptus* sp., Dead Man's Gully, Map Reference 614863, 29th November 1943; (3) one specimen, ACB 581, same locality, Map Reference 614863, 2nd January 1944. (All specimens in writer's collection.)

The Species of Neotrombidium

The species of the genus known at the present time are now:

Adults:

- N. furcigerum* Leonardi 1901, genotype, Argentine.
- N. ophthalmicum* (sic) (Berlese 1888), Paraguay.
- N. tricuspidum* Borland 1956, N. Carolina, U.S.A.
- N. barringtonense* Hirst 1928, Australia.
- N. tridentifer* n. sp., north Queensland, Australia.

Larvae:

- N. tricuspidum* Borland 1956, as above (reared and collected free).
- N. streblidum* (Wharton 1938) (= *Monunguis* Wharton 1938), Mexico.
- N. sp.* undescribed, Borland 1956, N. America.
- N. barringtonense* Hirst 1928, as above (reared).
- N. tenuipes* (Womersley 1954) (= *Cockingsia* Womersley 1954), Malaya.

The Systematics of the Larval Species

Of the larval species described, there is no difficulty in separating the Mexican species, *N. streblidum*, on the characters of the setae. Below are given, in tabular form, the Standard Data of *N. barringtonense* for the specimen described by the writer in 1954, and compared with the other species for which these data are available, *N. tenuipes* and *N. tricuspidum*.

Standard Data (in micra) for Larval *Neotrombidium*.

	<i>N. tenuipes</i> after Womersley 1954, from 13 specimens; means)	<i>N. tricuspidum</i> after Borland 1956		<i>N. barrin- gunense</i>
		Holotype	Mean of 9 spec.	
AW	44.6	55	52	51
PW	71.6	74	77	64
SB	42.4	52	51	43
ASB	67.2	81	81	69
PSB	14.0	18	18	23
SD	81.2	99	99	92
A-P	36.2	40	39	24
AM	29.8	28	28	22
AL	33.0	21	21	22
PL	22.6	18	20	18
Sens.	75.6	74	69	46
AMB*	—	21	19	18
DS	32 to 42	30	—	to 26

* The distance between the two AM setae.

As can be seen from the above, these three species differ significantly in a number of biometric data. Thus *N. tenuipes* has longer dorsal setae and AL setae than the other two species; *N. tricuspidum* has larger dimensions for SB, ASB, SD; *N. barringtonense* has smaller PW, A-P, AM and Sens.

A Note on the Biology of the Genus

Neotrombidium streblidum (Wharton 1938), known only from the larva, was captured parasitic on the Streblid flies *Pterellipsis araneae* Coquillett and *Trichobius dugesii* Townsend parasitic on the bat *Artibeus jamaicensis yucatanicus* (Allen) from a cave in Yucatan, Mexico. Womersley (1954) recorded *N. tenuipes* (Wom. 1954) "from specimens taken from the wings of a giant longicorn beetle from Sungai Buloh, Selangor, Malaya, 17.viii.1948 (J. R. Audy)". Borland (1956) recorded *Neotrombidium* sp. (an undescribed new species) "collected by Werner and Nutting on *Cymatodera peninsularis* (Coleoptera: Cleridae) in Brown's Canyon [,] Baboquiveri Mts., Arizona, July 18, 1949", and also that larvae of *N. tricuspidium* Borland 1956 were collected "parasitic on *Monochamus carolinensis* Oliv. (Coleoptera: Cerambycidae). Borland recorded also some inconclusive experiments to get reared larvae of *N. tricuspidium* to feed on some other species of beetles of the families Staphylinidae and Carabidae. On one occasion some of the larvae disappeared under the elytra of one species of Carabid, and were not recovered.

Thus, apart from the case of *N. streblidum*, the available evidence suggests that Coleoptera act as the hosts of the larvae, and possibly that the family Cerambycidae play an important role. Although the utilization of such hosts would account for a number of puzzling features in the biology of these mites, it is apparent that further investigation is required for firm conclusions to be drawn.

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(The following is a part bibliography only; the further references listed under the synonymy of *Neotrombidium* will be found in the papers marked by an asterisk (*) below.)

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